UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/705,799	11/10/2003	Mark W. Roberts	84151	4795

32697 7590 01/12/2007

OFFICE OF PATENT COUNSEL
SPAWARSYCEN, CODE 20012
53510 SILVERGATE AVE. ROOM 103
SAN DIEGO, CA 92152-5765

EXAMINER	
LEUNG, CHRISTINA Y	
ART UNIT	PAPER NUMBER
2613	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/705,799	ROBERTS ET AL.	
	Examiner	Art Unit	
	Christina Y. Leung	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 November 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *11-13 and 27-36* is/are allowed.

6)☒ Claim(s) *1-9 and 14-26* is/are rejected.

7)☒ Claim(s) *10 and 23-25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 November 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because element sin the figures should have descriptive as well as numeric labels. Particularly, elements 12, 14, 28, 52, and 58 in Figures 1-3 and 5 are currently represented only as blank boxes and should have descriptive labels. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 23-25 are objected to because of the following informalities:

In claims 23-25, a space (" ") should be inserted after the word "claim" in the first line of each claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 6 and 7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6 recites "said idler photons." There is insufficient antecedent basis for this limitation in the claim because claim 1 on which claim 6 depends does not previously recite "idler photons." Claim 7 depends on claim 6 and is therefore indefinite for the same reason.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-8, 14-17, and 20-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dress et al. (US 6,678,054 B1) in view of Ozeki et al. (US 7,046,366 B2).

Regarding claim 1, Dress et al. disclose an apparatus (Figures 1, 8, and 9) comprising:

a pulse source (laser 503) including a pulse generator for generating a pulse of photons;

a parametric down-converter (crystal 900) for receiving the pulse of photons, wherein photons that make up a portion of the pulse of photons are each parametrically down-converted into first and second photons, in which the first and second photons being such that alteration of

a characteristic of one of the first and second photons alters a corresponding characteristic in the other of the first and second photons (column 9, lines 1-29; column 10, lines 24-46);

a transmitter for receiving the first photons from the pulse source, the transmitter including a collapse event device (such as modulator MR as shown in Figure 8) for selectably altering the characteristic of the first photon (column 19, lines 22-24 and lines 42-44; column 20, lines 7-20; column 22, lines 11-40); and

a receiver for receiving the second photons from the pulse source, the receiver having a detector (including detectors 891 and 892 as shown in Figure 8) to detect alteration of the characteristic of the second photon (column 19, lines 45-53; column 22, lines 1-10).

Regarding claim 14, as similarly discussed above with regard to claim 1, Dress et al. disclose a method (Figures 1, 8, and 9) comprising:

projecting a pulse of photons through a parametric down-converter (crystal 900 as shown in Figure 1 and element 800 as shown in Figure 8) wherein photons that make up a portion of the pulse of photons are each parametrically down-converted into first and second down-converted photons, the first and second down-converted photons each having a center wavelength (column 9, lines 1-29; column 10, lines 24-46);

projecting the first down-converted photons to a receiver (including detectors 891 and 892 as shown in Figure 8);

projecting the second down-converted photons into an atmosphere (such as modulator MR as shown in Figure 8) wherein most of the center wavelengths of the second down-converted photons are altered if the second photons encounter a collapse condition in the atmosphere, the collapse condition causing a corresponding change in the center wavelengths of the first down-

converted photons as received at the receiver, and wherein the center wavelengths of the second down-converted photons are left unaltered if the second down-converted photons do not encounter the collapse condition in the atmosphere, leaving the center wavelengths of the first down-converted photon as received at the receiver unaltered (column 19, lines 54-64; column 22, lines 11-40); and

detecting whether the center wavelengths of the first down-converted photons as received at the receiver have been altered (column 19, lines 45-53; column 22, lines 1-10).

Regarding claims 1 and 14, Dress et al. do not specifically disclose that the receiver includes a nonlinear element for enhancing the detection or that the step of detecting includes projecting the first down-converted photons through a nonlinear element.

However, Ozeki et al. teach a system (Figure 7) that is related to the one disclosed by Dress et al., including a parametric down-converter 28 for receiving a pulse of photons and down-converting them into first and second photons such that that alteration of a characteristic of one of the first and second photons alters a corresponding characteristic in the other of the first and second photons (column 16, lines 6-29). Ozeki et al. further teach a receiver for receiving the photons, the receiver having a detector 67 to detection alteration of the characteristic of the photon, wherein the receiver includes a nonlinear element 56 for enhancing the detection (column 16, lines 30-67; column 17, lines 1-20).

Regarding claims 1 and 14, it would have been obvious to a person of ordinary skill in the art include a nonlinear element in the receiver as taught by Ozeki et al. in the system disclosed by Dress et al. in order to ensure that alterations in the second photon are effectively

detected by the system and ensure that the data communicated through these alterations are properly received.

Regarding claims 2 and 15, Dress et al. disclose that the first photon is an idler photon and wherein the second photon is a signal photon. Although they do not specifically use the terms "idler" and "signal" photons, Dress et al. disclose that the photons output from the down-converter are entangled such that one is a signal photon and the other is an idler photon which is the signal photon's entangled counterpart.

Regarding claim 3, Dress et al. disclose that the pulse generator is a laser (column 9, lines 1-5).

Regarding claims 4, 5, 16 and 17, Dress et al. disclose that the parametric down-converter is a nonlinear crystal comprising a Beta Barium Borate crystal (column 9, lines 5-9)

Regarding claims 6, 7, and 20-22, as well as claims 6 and 7 may be understood with respect to 35 U.S.C. 112 discussed above, Dress et al. disclose that the idler photons have a frequency and wherein the collapse event device of the transmitter includes a frequency measurer including a spectrometer (column 19, lines 54-64; column 22, lines 11-40). Dress et al. disclose generating a collapse event using an element tuned to a particular frequency/wavelength, wherein the element measures the frequency of idler photons by absorbing or scattering only photons of a certain frequency (column 22, lines 33-37).

Regarding claim 8, Dress et al. disclose that the receiver includes at least one photon detector (column 22, lines 1-10).

Regarding claim 23, Dress et al. disclose using a laser to project the projected pulse of photons through the parametric down-converter wherein the parametric down- converter is a nonlinear crystal (column 9, lines 1-5).

Regarding claim 24, Dress et al. disclose that purposeful causation of the collapse condition and a lack of purposeful causation of the collapse condition are used for communication (column 22, lines 11-40).

Regarding claim 25, Dress et al. disclose that sensing of the atmosphere is performed by equating changes in the center wavelength of the first photon with collapse condition changes in the atmosphere (column 19, lines 65-67; column 20, lines 1-20).

7. Claims 9 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dress et al. in view of Ozeki et al. as applied to claims 1 and 14 above, and further in view of Duling, III et al. (US 5,119,383 A).

Regarding claims 9 and 26, Dress et al. in view of Ozeki et al. describe a system as discussed above with regard to claims 1 and 14 above, including a nonlinear element in the receiver. Ozeki et al. particularly teach that the nonlinear receiver element is a SHG crystal and do not specifically disclose that it may be glass, but nonlinear elements of various types and compositions are generally well known in the optical signal processing art. Duling, III et al. in particular teach a related nonlinear element for processing an optical signal and further teach that a glass may be used to implement the nonlinear element instead of a SHG crystal (column 3, lines 49-64). Regarding claims 9 and 26, it would have been obvious to a person of ordinary skill in the art use glass as taught by Duling, III et al. as the nonlinear element in the system described

by Dress et al. in view of Ozeki et al. as an engineering design choice of an advantageously available and known material to implement the nonlinear element already described.

8. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dress et al. in view of Ozeki et al. as applied to claims 14 and 16 above, and further in view of Teich et al. (US 6,982,822 B2).

Regarding claims 18 and 19, Dress et al. in view of Ozeki et al. describe a system as discussed above with regard to claims 14 and 16 above, and Dress et al. disclose down-conversion in a nonlinear crystal as discussed above with regard to claim 16, and further discloses that the nonlinear crystal includes a Beta Barium Borate crystal (column 9, lines 5-9). Dress et al. do not further specifically disclose colinear, non-degenerate, type I phase-matching, but various ways of performing parametric down-conversion art known in the optical art. Teich et al. in particular teach a system that is related to the one described by Dress et al. in view of Ozeki et al., including using colinear, non-degenerate, type I phase-matching to perform parametric down-conversion (column 2, lines 51-67; column 3, lines 1-13). it would have been obvious to a person of ordinary skill in the art to use colinear, non-degenerate, type I phase-matching as taught by Teich et al. as an engineering design choice of a way to effectively implement the parametric down-conversion already disclosed. Dress et al. also already disclose that various types of crystals may be used to perform the down-conversion (column 9, lines 5-7).

9. Claims 1-4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gat (US 7,126,691 B2) in view of Ozeki et al.

Regarding claim 1, Gat discloses an apparatus (Figure 1) comprising:

a pulse source (laser 100) including, a pulse generator for generating a pulse of photons;

a parametric down-converter 200 for receiving the pulse of photons, wherein photons that make up a portion of the pulse of photons are each parametrically down-converted into first and second photons, in which the first and second photons being such that alteration of a characteristic of one of the first and second photons alters a corresponding characteristic in the other of the first and second photons (column 3, lines 57-65; column 5, lines 18-25);

a transmitter 400 for receiving the first photons from the pulse source, the transmitter including a collapse event device (rotatable polarizing beam-splitter 401) for selectably altering the characteristic of the first photon (column 5, lines 38-46; column 6, lines 1-27); and

a receiver 300 for receiving the second photons from the pulse source, the receiver having a detector 303 to detect alteration of the characteristic of the second photon (column 6, lines 28-37)

Regarding claim 1, Gat does not specifically disclose that the receiver includes a nonlinear element for enhancing the detection.

However, Ozeki et al. teach a system (Figure 7) that is related to the one disclosed by Gat, including a parametric down-converter 28 for receiving a pulse of photons and down-converting them into first and second photons such that that alteration of a characteristic of one of the first and second photons alters a corresponding characteristic in the other of the first and second photons (column 16, lines 6-29). Ozeki et al. further teach a receiver for receiving the photons, the receiver having a detector 67 to detection alteration of the characteristic of the photon, wherein the receiver includes a nonlinear element 56 for enhancing the detection (column 16, lines 30-67; column 17, lines 1-20).

Regarding claim 1, it would have been obvious to a person of ordinary skill in the art include a nonlinear element in the receiver as taught by Ozeki et al. in the system disclosed by Gat in order to ensure that alterations in the second photon are effectively detected by the system and ensure that the data communicated through these alterations are properly received.

Regarding claim 2, Gat discloses that the first photon is an idler photon and wherein the second photon is a signal photon. Although Gat does not specifically use the terms "idler" and "signal" photons, Gat discloses that the photons 502 and 503 are entangled such that one is a signal photon and the other is an idler photon which is the signal photon's entangled counterpart.

Regarding claim 3, Gat disclose that the pulse generator 100 is a laser (column 5, lines 20-21).

Regarding claim 4, Gat discloses that the parametric down-converter is a crystal (column 3, lines 57-61), but Gat does not specifically disclose further details regarding a type of crystal. However, Ozeki et al. further teach a parametric down-converter comprising a nonlinear crystal (column 6, lines 28-67; column 7, lines 1-3). it would have been obvious to a person of ordinary skill in the art to use a nonlinear crystal as taught by Ozeki et al. in the system disclosed by Gat in order to implement the parametric down-conversion already disclosed and properly output pairs of entangled photons as already disclosed.

Regarding claim 8, Gat discloses that the receiver includes at least one photon detector (column 6, lines 28-35).

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gat in view of Ozeki et al. as applied to claims 1 and 4 above, and further in view of Dress et al.

Regarding claim 5, Gat in view of Ozeki et al. describe a system as discussed above with regard to claims 1 and 4, including a parametric down-converter comprising a nonlinear crystal, but they do not specifically disclose a Beta Barium Borate crystal. However, Dress et al. teach a system that is related to the one described by Gat in view of Ozeki et al. including a parametric down-converter, and they further teach that the parametric down-converter is a nonlinear crystal comprising a Beta Barium Borate crystal (column 9, lines 5-9). Regarding claim 5, it would have been obvious to a person of ordinary skill in the art to include a Beta Barium Borate crystal as taught by Dress et al. in the system described by Gat in view of Ozeki et al. in order to implement the parametric down-conversion already disclosed and properly output pairs of entangled photons as already disclosed.

11. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gat in view of Ozeki et al. as applied to claim 1 above, and further in view of Duling, III et al.

Regarding claim 9, Gat in view of Ozeki et al. describe a system as discussed above with regard to claim 1 above, including a nonlinear element in the receiver. Ozeki et al. particularly teach that the nonlinear receiver element is a SHG crystal and do not specifically disclose that it may be glass, but nonlinear elements of various types and compositions are generally well known in the optical signal processing art. Duling, III et al. in particular teach a related nonlinear element for processing an optical signal and further teach that a glass may be used to implement the nonlinear element instead of a SHG crystal (column 3, lines 49-64). It would have been obvious to a person of ordinary skill in the art use glass as taught by Duling, III et al. as the nonlinear element in the system described by Gat in view of Ozeki et al. as an engineering design

choice of an advantageously available and known material to implement the nonlinear element already described.

Allowable Subject Matter

12. Claims 11-13 and 27-36 are allowed.

13. Claim 10 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

14. The following is a statement of reasons for the indication of allowable subject matter:

The prior art, including Dress et al., Ozeki et al., Gat, Duling, III et al. and Teich et al., does not specifically disclose or fairly teach a system including all the elements and limitations recited in claims 10, 11-13, and 27-36 (including all of the limitations of any parent claims on which they depend), particularly wherein the parametric down-converter provides non down-converted photons and down-converted photons to the receiver in the way specifically recited in the claims.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christina Y. Leung whose telephone number is 571-272-3023. The examiner can normally be reached on Monday to Friday, 6:30 to 3:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571-272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2600.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Christina Leung

CHRISTINA LEUNG
PRIMARY EXAMINER